

**PACIFIC SALMON COMMISSION
JOINT CHUM TECHNICAL COMMITTEE
2005 POST SEASON SUMMARY REPORT**

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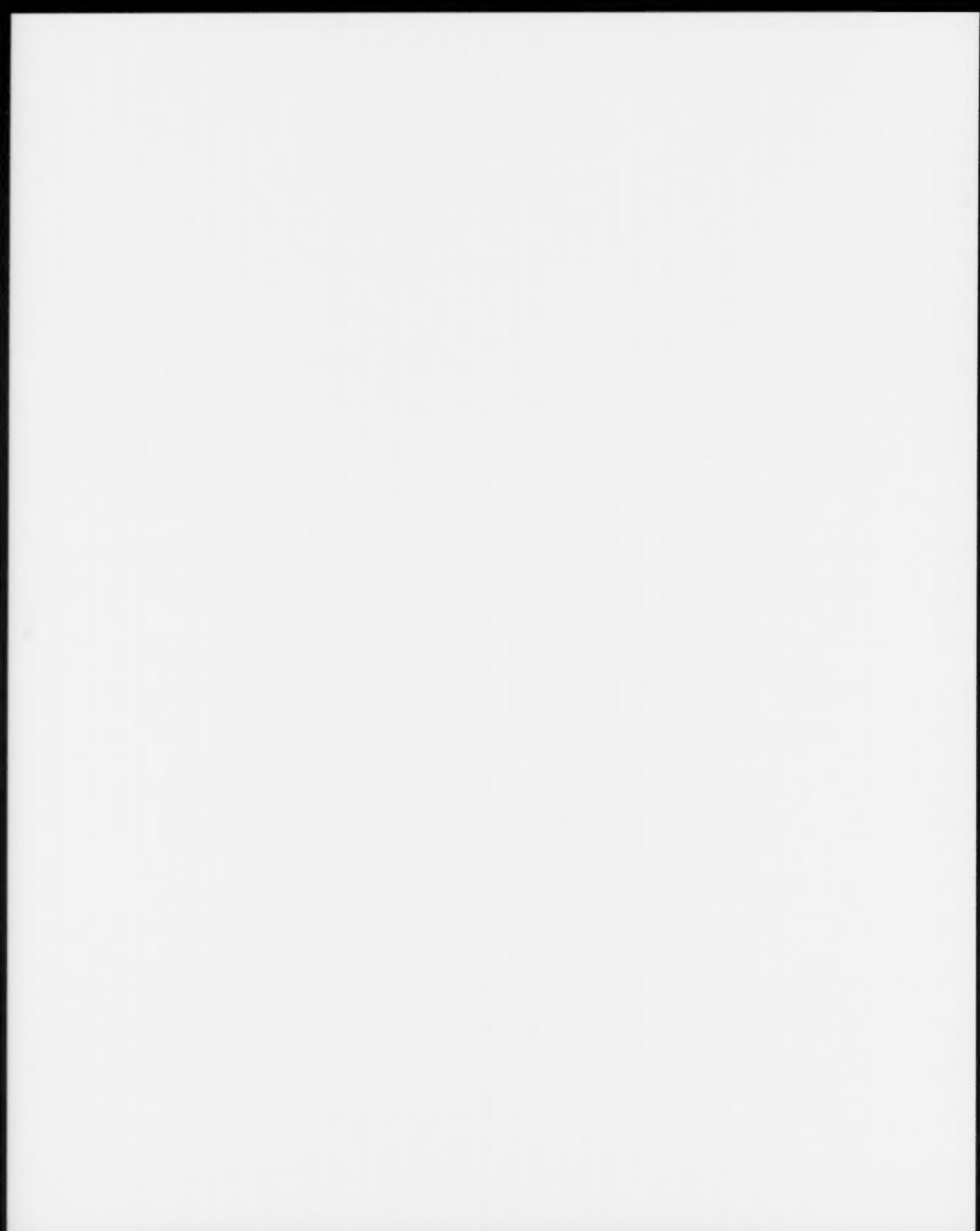
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1. INTRODUCTION

This Joint Chum Salmon Technical Committee report presents the appropriate information on chum salmon stocks and fisheries in southern British Columbia and Washington for the years 2005 to address the specific provisions and requirements of Chapter 6 of Annex IV of the Pacific Salmon Treaty (PST) (Attachment 1) and the Commission's guidance concerning additional agreements between the parties (Attachment 2).

The treaty between the governments of Canada and the United States of America (U.S.) concerning Pacific salmon was designed to facilitate co-operation between the two countries in the management, research and enhancement of Pacific salmon stocks.

Chapter 6 of Annex IV (Chum Annex) of the Pacific Salmon Treaty (PST) required that certain fisheries for chum salmon in southern British Columbia (B.C.) and Washington be managed in a specified manner. Other fisheries, while not specifically mentioned in the PST, are known to harvest chum salmon originating in the other country. This report presents various aspects of the chum found in Washington State and in B.C. waters between Vancouver Island and the mainland and off the west coast of Vancouver Island, and discusses the management actions of Canada and the U.S. in relation to the PST requirements.

In 1999 a new Chum Annex was negotiated and adopted by the parties for a term of 10 years (Attachment 1). Certain provisions of this Annex were updated, relative to earlier versions, to be consistent with the changes in the "Clockwork" management strategy implemented by Canada for fisheries in Johnstone Strait. It also included additional conservation provisions to address concerns of the United States for Hood Canal-Strait of Juan de Fuca summer chum salmon, which have been listed as a "threatened" species under the United States' Endangered Species Act.

In 2002, Canada implemented a significant change in Southern B.C. chum management replacing the "Clockwork" stepped exploitation rates in favor of a fixed fishing schedule designed to approximate a total harvest rate of 20%. The Parties managed their fisheries through 2005 within the spirit of the existing Annex and the Commission's guidance.

In 2004, the Parties were given additional Commission guidance that modified certain provisions of the Chum Annex (Attachment 2, February 13, 2004). The purpose of the guidance document was to provide Commission direction to the Southern Panel on the conduct of southern chum salmon fisheries for the years 2004 to 2008. This direction was not intended to replace Annex IV, Chapter 6 of the Pacific Salmon Treaty but to address a change in Canadian management, which suspended development of pre-season run size estimates of chum to Canadian waters. The guidance document outlines agreement on modifications to the limits for the U.S. chum salmon fishery in Areas 7 and 7A. This modification disconnects the harvest levels in the U.S. from catch volume in Canada. The U.S. fishery in Areas 7 and 7A was managed pursuant to the Commission guidance to the Southern Panel on the management of southern chum fisheries. The guidance further provided for an additional linkage of the U.S. fishery, in Area 7 and 7A,

to the abundance of chum salmon returning to the Fraser River. Additionally, the guidance document provided for conditional exploitation rates for Canadian fisheries based on specific levels of abundance.

2. STATUS OF TREATY REQUIREMENTS

Chum stocks and fisheries in southern British Columbia and in United States Areas 4B, 5, 6C, 7, and 7A (*See: Attachment 3*) are managed under the terms set out in the Chum Annex of the Pacific Salmon Treaty (as amended and expanded by the Commission's 2004 Guidance). The following provides a brief synopsis of the provisions of the Chum Annex and of Canadian and U.S. management actions taken to meet those provisions for the year 2005.

2.1 Paragraph 1:

The Parties were to maintain a Joint Chum Technical Committee (Technical Committee) to review stock status, develop new methods for stock management and report on management and research findings.

The Technical Committee convened twice during 2005 during the PSC post-season and pre-season annual meetings. The Committee completed the 2004 post season report and continued to work on developing criteria for endowment fund projects specific to the Chum Annex. The Committee continued discussions on the development of a southern chum DNA baseline for future stock composition work.

2.2 Paragraph 2:

Canada was to manage its inside fisheries to provide rebuilding of depressed naturally spawning stocks and minimize increased interceptions of U.S. chum.

Table 1 provides an evaluation of the performance of the Clockwork (1996–2001) and current management strategy (2002–2005). The total estimated escapement for Inside chum stocks met or exceeded the goal of 2.5 million in eight of the past 10 years. Stock identification information has been limited in recent years, but what is available suggests minimal interception of U.S. chum stocks.

2.3 Paragraph 3:

Canada was to manage its Johnstone Strait Clockwork harvest to set exploitation rates dependent on the run size entering Johnstone Strait, as determined inseason. The catch level of chum salmon in U.S. fishing Areas 7 and 7A was determined by the catch of chum salmon in Johnstone Strait. In addition, the total proportion of effort and catch between Areas 7 and 7A was to be maintained.

Note: For 2004, a number of these provisions were modified by the Commission's Guidance (Attachment 2). *Canada was to manage its Johnstone Strait fishery for a*

maximum total exploitation rate of 20%, unless a critically low return was identified. In that case, Canada was to suspend its commercial fisheries in that area. For U.S. fisheries, in Areas 7 and 7A, unless a critically low return was identified, a base catch level of 130,000 chum was applied, plus a portion (46,000) of the accumulated catch difference. If a critically low return were identified by Canada, the catch level in the U.S. fishery was limited to 20,000.

Canada implemented a significant change in Southern B.C. chum management beginning in 2002, modifying the "Clockwork" stepped exploitation rates to a fixed fishing schedule designed to approximate a total harvest rate of 20%. Results of this new approach are provided in Table 1. The U.S. chum fisheries in Areas 7 and 7A were managed on a base catch ceiling of 130,000 chum providing the run is updated above the critical abundance level, as provided by Canada, of inside southern bound chum stocks. For abundance below the 130,000 base catch ceiling, a minimum catch of 20,000 is identified. The proportion of catch between Areas 7 and 7A is shown in Table 12, and is generally consistent with the historical distribution.

The 2004 Guidance also provided for U.S. fishery management actions if the inseason estimated abundance of chum entering the Fraser River failed to reach a threshold of 900,000.

Inseason estimates indicated a return higher than the specified threshold, so no additional action was necessary.

2.4 Paragraph 4:

The U.S. was to maintain the limited effort nature of its chum fishery in U.S. Areas 4B, 5, and 6C to minimize increased interceptions of Canadian chum. In addition, the U.S. was to monitor this fishery for increasing interceptions of Canadian chum.

This fishery has continued to be restricted to gillnet gear only and to treaty Indian fishers from four tribes. The technical committee has not specifically addressed interception estimates during the 1994 through 2005 time period, or the issue of "minimizing increased interceptions" in 2005, primarily because of extremely low level of harvest. However, GSI samples collected from this fishery in prior years indicate the majority of the catch is chum salmon of U.S. origin, and the total catch and effort in this fishery has declined significantly in recent years (see Table 10). Therefore, interceptions have likely decreased as well.

2.5 Paragraph 5:

When the catch of chum salmon in U.S. Areas 7 and 7A fails to achieve the specified ceiling, the ceiling in subsequent years will be adjusted accordingly.

Note: For 2005, this provision was modified by the Commission's Guidance. *The Guidance specified a default total annual catch ceiling which included; first, the base*

catch ceiling (130,000), then an amortized historical accumulated difference (for 2005, 46,000). It also specified that if the U.S. fisheries failed to reach their total annual catch ceiling, the historical accumulated difference would not be carried to subsequent years.

The U.S. fishery in Areas 7 and 7A fell short of its catch ceiling in 2005 by 56% and harvested none of the amortized historical difference (see Table 12).

2.6 Paragraph 6:

Catch composition in fisheries covered by this chapter was to be estimated post-season using methods agreed upon by the Joint Chum Technical Committee.

The committee used agreed upon methods to estimate catch composition for 2005 fisheries, using historical estimates of stock contribution. Updated estimates of stock composition were not available for 2005.

2.7 Paragraph 7:

Canada was to manage the Nitinat chum fishery to minimize the harvest of non-targeted stocks.

In 2005, Canada has addressed specific by-catch concerns by delayed opening dates, continued use of reduced fishing area, use of weed lines, and species selective fishing techniques.

2.8 Paragraph 8:

Canada was to conduct genetic stock identification (GSI) sampling of the West Coast Vancouver Island troll fishery (Areas 121–124) if catch levels were predicted to reach levels similar to those in 1985 and 1986.

Chum catch levels in the 2005 West Coast Vancouver Island troll fishery were significantly below the 1985 and 1986 levels. Therefore, no GSI sampling occurred.

2.9 Paragraph 9 (added in 1999):

From August 1 to September 15 of each year, purse seine fisheries in Canadian Area 20 and non-Indian seine fisheries in U.S. Areas 7 and 7A shall release all chum salmon.

Regulations have been implemented by both countries to require the live release of chum salmon in these areas during this time-period.

2.10 Paragraph 10 (added in 1999):

The parties will assess chum catches and attempt to collect GSI samples from boundary area fisheries during the August 1 to September 15 time period.

Tables 4 and 11 provide the catch of chum salmon during the period of summer chum migration in boundary areas. Due to the low numbers of chum encountered during this time period, neither party collected any GSI samples.

3. CANADIAN INSIDE CHUM

3.1 Introduction

Southern B.C. chum salmon stocks and fishing areas are, for the purposes of management, analysis and reporting, divided into two major components. The stocks of Johnstone and Georgia straits and the Fraser River are described as Inside chum. The primary fisheries of concern for 2005 are the Johnstone and Georgia Straits and the Fraser River.

3.2 Status of Treaty Requirements

A bilateral agreement for sharing of chum salmon was reached on June 30, 1999. Canada and the U.S. agreed to implement, without any prejudice to future agreements, the most recently expired sharing arrangement as outlined in Chapter 6 of Annex IV of the Pacific Salmon Treaty. Canada implemented a significant change in Southern B.C. chum management beginning in 2002, replacing the "Clockwork" stepped exploitation rates in favor of a fixed fishing schedule designed to approximate a total harvest rate of 20%. As a result of this change, guidance was provided by the Commission in 2004 (Attachment 2) pertaining to the management of the Inside chum fisheries. The purpose of this document was to provide Commission direction to the Southern Panel on the conduct of southern chum salmon fisheries for the years 2004 to 2008. This direction was not intended to replace Annex IV, Chapter 6 of the Pacific Salmon Treaty but was to be used on an interim basis.

3.3 Conservation and Harvest Management Requirements

Inside chum are managed with the long-term objective of providing maximum benefits to the fishing industry. The general approach adopted by Fisheries and Oceans Canada (DFO) is to achieve the present target wild escapements, while augmenting production through enhancement of selected stocks. In practice, this approach is achieved through the application, in mixed stock fishery areas, of harvest rates which are compatible with wild or natural stock productivity. If there are stocks which return to their area of origin in numbers above that area's escapement goal, they may be subjected to additional harvesting in the appropriate terminal area.

The following describes the harvest strategy, Pacific Salmon Treaty (PST) requirements for Inside chum and discusses Inside (Johnstone Strait, Fraser River, and mid Vancouver Island/Georgia Strait) chum stocks in relation to these plans.

3.3.1 Harvest Strategy for Johnstone Strait

The Clockwork strategy in use from 1983 to 2001 was described in the Final 1985 Post Season Summary Report of the Joint Chum Technical Committee (TCCHUM 87-4). The Clockwork strategy was designed to rebuild wild chum stocks to the estimated optimum escapement levels by limiting the overall harvest rate. Ryall et al. 1999 (Canadian Stock Assessment Secretariat Research Document 99/169), provided an assessment of the effectiveness of the Clockwork strategy. The Clockwork management strategy required accurate estimates of catch and escapement and the reliability of this strategy depended upon the quality of these data. During the time period in which Inside chum stocks were managed by the Clockwork strategy, the high variability in chum returns, the inadequate escapement coverage, and highly unstable fishing opportunities demonstrated a need to move to an alternative approach.

Following extensive technical reviews and several years of discussions with First Nations, stakeholders and the commercial fishing industry, the stepped exploitation rate approach (“Clockwork”(described in TCCHUM 87-4)) was replaced by a stable fishing schedule designed to approximate a fixed exploitation rate (~20%). Some of the key objectives of this strategy are to ensure sufficient escapement levels while providing more stable fishing opportunities. The exploitation rate is set at 20% across all harvesters, when abundance is above critical level. Of this 20%, 15% is allocated to the commercial sector, and the remaining five percent is set aside to satisfy Food/Social/Ceremonial (FSC), recreational, test fish requirements and to provide a buffer to the commercial exploitation. Tagging studies conducted in 2000, 2001 and 2002 helped in the development of this strategy by assessing the migration timing and harvest rate on an available abundance of chum in the Johnstone Strait. The impact of the Johnstone Strait fisheries, Clockwork years (1994–2001) and new approach (2002–2005), on Inside chum stocks are detailed in Table 1.

Table 1. Assessment of Clockwork and the current Johnstone Strait Chum Management 1996–2005.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
PRE-SEASON										
Forecast	Above Average	Above Average	Above Average	Below Average	Below Average	Below Average	Average to Above	Below Average	Average	Average to Above Average
POST-SEASON										
<u>Inside Area Abundance</u>	1,645,597	2,661,373	7,463,883	3,639,912	1,260,039	4,815,599	5,022,327	3,681,426	5,403,285	2,892,037
Inside Area Catch	318,514	411,547	2,651,840	231,169	260,704	661,775	1,529,397	1,380,729	1,814,828	1,087,304
Estimated Harvest rate	19.4%	15.5%	35.5%	6.4%	20.7%	13.7%	30.5%	37.5%	33.6%	37.6%
Johnstone Strait (JS) Catch										
Commercial Areas 11-13	76,223	65,668	1,536,218	38,002	158,676	188,862	586,084	877,746	1,129,154	843,975
First Nations Areas 11-13	21,956	17,075	2,479	11,736	14,899	23,562	17,131	10,482	20,087	9,595
Johnstone Total	98,179	82,743	1,538,697	49,738	173,575	212,424	613,215	888,228	1,149,241	853,570
Target Harvest Rate ²	10%	10%	40%	20%	10%	20%	20%	20%	20%	20%
Estimated Harvest Rate	6.0%	3.1%	20.5%	1.4%	13.8%	4.4%	12.2%	24.1%	21.3%	29.5%
ESCAPEMENT (includes wild and enhanced)										
	1,327,083	2,249,826	4,812,043	3,408,743	999,335	4,153,824	3,492,930	2,300,697	3,588,457	1,804,733

(1) Total inside area stock includes total 2004 inside area catch plus escapement. Total inside area catch includes all inside Area catches (Inside area catch composition based on historic GSI for all fisheries).

(2) Desired harvest rate pre 2002 based on Clockwork management strategy. Desired harvest rates post-2001 are based on 20% fixed harvest rate approach.

For 2005, the specific objectives of the fixed exploitation strategy were to:

- Continue to rebuild/maintain stocks to the optimum wild escapement objective (defined as 2.5 million wild Inside chum);
- Establish a preseason fishing plan to achieve the commercial allocation of 15%;
- Stabilize commercial catch to provide opportunities at both low and high abundance levels.

3.3.2 Fraser River Chum Management Strategy

The harvest management plan for Fraser River chum was implemented to provide management goals and fishing limits for the harvest of Fraser River chum in the terminal area.

Historically, the terminal run was further divided into early and late segments with escapement goals and harvest guidelines set independently for each segment. In 1992, the minimum gross escapement goal for the early and late segments was set at 390,000 and 350,000 respectively, including First Nations fishing and test fishing requirements. The plan provided for either escapement goal to be increased in season if the return to the river exceeded the pre-season goal. For the early chum run, the harvest was not to exceed 10% on a terminal run size in the range of 425,000 to 550,000 and for a terminal run of over 550,000 the harvest rate was increased to 15%. For the late chum run, the harvest was not to exceed 10% of a terminal run size in the range of 385,000 to 500,000 and for a terminal run of over 500,000 the harvest rate was increased to 15%. This allowed an upward scaling of the escapement goal with an increase in the run size.

In 1999, the escapement goal (following two recommendations from PSARC, 1992 and 1999) was increased to 800,000 and the early and late run escapements were increased proportionately. There have been ongoing discussions regarding the validity of managing the run based on early and late components; there is little current documentation to support the concept. Since 2002, the Fraser run has been managed on the basis that it is a single aggregate. While evidence for bi-modality of run timing was evident in the past at the Cottonwood test fishery and from run timing into individual systems, this characteristic has never been detected in the Albion test catches from which inseason run size estimates are derived.

3.3.2.1 Fraser River Management Rules

Rule 1. Directed harvest will not occur unless the run size estimate derived from cumulative test fishing catches predicts that the abundance of chum exceeds the gross escapement goal. For computational purposes, a commercial fishery within the river will be considered to harvest a minimum of 35,000 chum. The harvest rate schedule (Table 2) will be used to determine the available surplus.

Table 2. Commercial harvest rate schedule for the Fraser River

Run Timing	Terminal Run Size	Management	Potential Catch
October 1–November 30	916,000–1,050,000	Minimum Gross Escapement Goal ¹ = 881,000; One opening not to exceed 10% harvest rate	35,000–105,000
	>1,050,000	Set harvest rate at 15%	144,000+

¹ (Gross Escapement Goal = Net Escapement (800,000) + Test Catch (9,000) + Native Harvest 72,000) = 881,000

Rule 2. Albion test fishing data will be used to determine the timing of commercial openings. In 2002, a Bayesian based, run size estimation model was adopted. Test fishing data from September 1 to October 20 is required to establish the estimated run size. Since 1998, the test fishery has operated on alternate days to reduce coho by-catch.

Rule 3. The standard openings for directed commercial chum harvesting will be inside the river (Sub-areas 29-11 through 29-17).

Rule 4. The daily commercial chum openings will be structured to avoid night fishing.

Rule 5. Whenever practical, 24 hours notice will be given for openings; however, shorter notice may sometimes be required. Notices to Industry, advising of run status and possible management actions will be issued when appropriate.

Rule 6. The minimum mesh size of 158 mm (approximately 6.25") has been in effect since 1995.

Rule 7. Area E license conditions include: fish slips, observers, logbooks, hauls, revival tanks, etc. Inseason advisors will be updated on current status through conference calls.

Rule 8. Conservation of Thompson River coho became a major issue in 1997 and will likely remain so for the foreseeable future. Fishing restrictions between August 29 and October 15 in Area 29 can be anticipated. Conservation of Thompson and Chilcotin River steelhead will result in fishing restrictions in later October and possibly early November. Potential low returns of Harrison River Chinook are also a consideration if earlier fisheries are proposed.

Rule 9. The B.C. Ministry of Water, Lands and Air Protection (MWLAP) has used Albion test fishing data to estimate abundance of Interior Fraser steelhead. Fishing related mortality is estimated with a steelhead harvest model the MWLAP also developed. Conservation measures during inriver fisheries are discussed with CDFO. Commercial fisheries are not allowed before late October to protect Interior Fraser steelhead. Exact timing of commercial and First Nations net fisheries were finalized following discussions with provincial staff.

3.3.2.2 Fraser River Inseason Run Size Estimation

A test fishery has operated at Albion on the Fraser River since 1978 to provide the means for an index of chum salmon abundance (escapement) within a season. Recent degradation of the accuracy and consistency of escapement estimates has seriously undermined the potential to evaluate Clockwork management for the Fraser River chum salmon (PSARC paper S99-20, Ryall et al. 1999). To address this problem the cumulative catch-per-unit-effort (CPUE) was calculated to account for saturation, depletion in the second set and interpolation for missing sampling days. In addition, the test fishery data were cast into a Bayesian framework that incorporated preseason knowledge of run size and migration timing, with inseason information on migration timing and a predictive regression to calibrate run size to the historical record. Based on a retrospective analysis of 1979-1998 data, the Bayesian procedure was judged superior to the classical test fisheries approach of using a simple predictive regression of cumulative CPUE on run size (Gazey and Palermo, 2000). However, the predictive ability of both models was seriously compromised by the reliability of escapement

enumeration. The new Bayesian procedure for estimating inseason Fraser River chum run size has been in use since the 2000 fishing season.

In 2005, estimates of Fraser River total run size were made from test fishing conducted within the Fraser River between September 1 and November 22.

3.3.3 Strait of Georgia Chum Management Strategy

Chum stocks returning to the terminal areas are directly affected by the harvest in Johnstone Strait. A portion of this return is harvested in Johnstone Strait. Chum returning to mid Vancouver Island (Area 14) are primarily from enhancement facilities. Terminal harvesting is directed at a mix of surplus mid Vancouver Island wild and enhanced chum, with the conservation requirements of passing chum stocks considered. Conservation requirements of local chinook and coho salmon in this fishery area are also considered in determination of area closures for the Area 14 chum fishery.

Terminal surpluses were estimated from escapement, test and commercial harvesting. Areas for potential terminal fishing in the Strait of Georgia occur at mid Vancouver Island (Area 14), Jervis Inlet (Area 16), Nanaimo (Area 17) and Cowichan (Area 18). Terminal area harvests occurred when surpluses were identified.

3.4 Planning, Implementation and Post Season Review

3.4.1 Preseason Planning

For 2005, there was no formal forecast provided for Inside chum. A stock status outlook was provided taking into account brood year performances and trends in recent marine survival indices. Even though the brood year return in 2001 was one of the lowest on record, there has been significant improvement in survival in recent years. For 2005, the outlook for Inside chum was for an average to below average return abundance.

Prior to the season, a preseason commercial fishing plan was established through consultation with commercial user groups. Each plan was designed to achieve the 20% target based on the specific gears estimated daily harvest rate at an anticipated effort level. The one deviation from recent years was the planning of a demonstration purse seine quota based fishery to access a portion of their allocation of the 20%. The quota was to be calculated based on the modelled impact of the reduced effort fixed competitive openings and distributing the balance of the purse seine allocation to the identified quota vessels.

3.4.2 Inseason Implementation

In 2005, the test fishery, which consisted of two purse seine vessels fishing from early September until late October on a daily basis was pivotal in establishing run timing, relative abundance and stock structure information. This test fishery provided a relative indication of Inside chum abundance over the historic time series.

In 2005, the first purse seine opening was essential for the establishment of the quota catch. Competitive seine, troll and gill net fisheries were conducted based on the preseason plan. Modifications to the gillnet plan were made to account for variation in effort participation compared to the pre-season expectations. Table 3 outlines the duration of fishery openings during the 2005 season.

Table 3. Johnstone Strait chum commercial openings 2005 (hours open).

Year	Statistical Week	Statistical Area					
		12			13		
		Seine	Gillnet	Troll	Seine	Gillnet	Troll
2005	10-1			48			48
	10-2	12	41	120	12	41	120
	10-3		41	48		41	48
	10-4	10	38		10	38	
2005 Total		22	120	216	22	120	216

3.4.3 Post Season Review

The total chum catch in all Inside areas (including the catch of Canadian chum in U.S. Areas 7 and 7A), plus Inside chum gross escapements were summed to estimate the total Inside chum assessed run size. An evaluation table of Inside chum management goals, stock sizes, catch, escapement, and harvest rates are presented in Table 1.

3.5 Catch/Fishery

Fall chum in Inside waters are harvested by commercial, First Nations, recreational and test fisheries. Commercial catch of chum in Inside waters occurs in three main areas: Johnstone Strait, Strait of Georgia and the Fraser River. Fall chum fisheries generally begin in late September and end in November. In addition, a by-catch of chum may occur in fisheries directed at sockeye and pink. This chum by-catch is assumed to be comprised mainly of summer chum destined for streams in the Johnstone Strait and Canadian central coast areas and is not part of the directed chum fishery management plan. The summer chum catches are presented in Table 4.

3.6 Escapement

Chum that escape the commercial, First Nations, recreational and test fisheries form the gross escapement to Inside chum streams. This gross escapement is made up of chum that spawn in wild areas, those which are spawned in enhancement facilities, and those which are surplus to facility requirements and are removed from the spawning areas. Gross escapement estimates are used in reconstruction of the total run size in a given year.

Table 4. Catch of chum salmon by statistical area for commercial, research and test fishing vessels (July through the second week of September).

Year	Statistical Week	Statistical Area					Total
		18	19	20	21	29	
1996	7/1-9/2	0	0	528	12	494	1,034
1997	7/1-9/2	0	0	409	0	215	624
1998	7/1-9/2	0	0	50	0	46	96
1999	7/1-9/2	0	0	35	0	0	35
2000	7/1-9/2	0	0	37	0	73	110
2001	7/1-9/2	0	0	26	0	77	103
2002	7/1-9/2	0	0	37	0	197	234
2003	7/1-9/2	0	0	27	0	51	79
2004	7/1-9/2	0	0	17	0	534	551
2005	7/1-9/2	0	0	0	0	115	115
Area Total		0	0	1,166	12	1,851	3,029

Some Inside area streams support summer chum populations. These are relatively minor stocks and because of their distinctively early run timing in Johnstone Strait, i.e. July to late August, they are not included in the escapement total for the fall chum run.

The primary enhanced escapement areas are presently limited to the mid Vancouver Island and Fraser River areas. The enhancement facilities in the mid Vancouver Island consist of Big Qualicum, Little Qualicum and Puntledge rivers. Fraser River enhancement facilities are located on the Inch (Inch and Stave stocks), Chilliwack, Chehalis and Weaver Rivers, however production from the Fraser facilities has declined sharply recently as resources were channelled elsewhere.

The stocks which are managed within the context of the Inside chum plan are the fall run chum. These chum enter Johnstone Strait during the September to November time period. Escapement estimates, for Inside chum since 1995, are presented in Table 5.

3.7 2005 Inside Area Fishery Descriptions.

The annual detailed summary is a description of the run size and harvest strategies on a weekly or commercial fishery basis. The description contains run size forecasts, commercial opening times, harvest rate goals, and commercial and First Nations' catches.

Preseason expectations for 2005 indicated an average to above average return for Inside chum salmon stocks.

Table 5. Inside chum spawning escapement for wild and enhanced groupings (Fraser and Non-Fraser) for 1996–2005.

Grouping	1996 Estimate	1997 Estimate	1998 Estimate	1999 Estimate	2000 Estimate	2001 Estimate	2002 Estimate	2003 Estimate	2004 Estimate	2005 Estimate
Fraser (Wild + Enhanced)	777,724	1,531,958	3,469,993	2,891,794	689,452	3,095,147	2,248,798	1,580,179	2,610,195	1,287,379
Non-Fraser (Wild + Enhanced)	549,359	717,868	1,342,050	516,949	309,883	1,058,677	1,244,132	720,518	978,262	517,354
Total	1,327,083	2,249,826	4,812,043	3,408,743	999,335	4,153,824	3,492,930	2,300,697	3,588,457	1,804,733

3.7.1.1 Johnstone Strait.

There were eight competitive commercial and one quota based chum fisheries in Johnstone Strait in 2005. The first competitive fishery occurred on September 30–October 2 (troll 72 hours). The catch for this fishery was 14,000 chum. The first competitive purse seine fishery occurred on October 3 (12 hours) and harvested a 255,000 chum. The third fishery on October 4–7 (troll 96 hours) harvested 25,000 chum. The next fishery (gillnet 41 hours) on October 6–8 caught 46,000 chum. The fifth fishery (troll 48 hours) on October 11–12 harvested 8,500 chum. Another gill net fishery (for 41 hours) occurred on October 11–13 harvesting an additional 41,000 chum. The last gillnet fishery (for 37 hours) occurred on October 17–19 and harvested 62,000 chum. The second competitive purse seine opening occurred on October 24 (10 hours) harvested 170,000 chum. The quota purse seine fishery occurred between October 6–21 and harvested 184,000 chum.

The total 2005 commercial catch for Johnstone Strait (Areas 12 and 13) was 844,000 chum. There were no directed chum fisheries in terminal areas of Johnstone Strait. In addition, First Nation, recreational and test fishing catches were estimated at 19,000, 10,000 and 43,000 chum respectively for the 2005 season.

3.7.1.2 Strait of Georgia

Directed commercial chum fisheries in the Strait of Georgia occurred in Qualicum and Nanaimo.

The Qualicum (Area 14) gillnet openings occurred from October 11–14, 17–19, 24–30, November 2–9 for a total of 22 days. Gillnet catches totaled approximately 30,000. The troll fishery was open for 25 days on October 10–14, 17–21, 24–30, and November 2–9. Troll catches totaled 360. A seine fishery occurred on October 31 and November 1 for a catch of 320.

In Jervis Inlet (Area 16) no commercial fisheries occurred as stock levels appeared to be below target escapement. A one day troll test fishery occurred on October 31 in Lower Jervis Inlet (16-11) but there was no catch.

The Nanaimo (Area 17) gillnet openings occurred from October 23-25, and October 30 to November 1. Gillnet catches totaled approximately 2,660. Troll fisheries were open on the same dates, but there was no effort or catch for these openings. No seine fisheries occurred.

There were no commercial openings in Satellite Channel (Area 18) due to low estimated escapement in the Cowichan River. A test fishery occurred between November 1 to 16 for a total of 9 days harvesting approximately 11,000 chum.

The total 2005 commercial catch estimate for Strait of Georgia chum was approximately 44,000. Additional catch by First Nations (Cowichan 1,750 and Goldstream 400) of 2,150 resulted in a total catch estimate of approximately 47,000 chum in the Strait of Georgia.

3.7.1.3 Fraser River

There were two fisheries in the Fraser River, one on October 20 (gill net 10 hours) and one on November 4 (gill net 10 hours). Total catches in these fisheries were 38,000 and 32,000, respectively, for a total of 70,000 chum salmon. The First Nation fishery in the lower Fraser River caught 71,000 chum, of which 20,500 were FSC and 50,500 were Economic Opportunity (EO). The test fishing catch at Albion was 13,000. The final in-season estimate (based on Albion catch data) on November 30, was calculated to be 1.8 million.

4. WEST COAST VANCOUVER ISLAND CHUM

4.1 Conservation and Harvest Management Requirements.

Chum salmon stocks return to all Statistical areas on the west coast of Vancouver Island (WCVI). The most significant WCVI group of stocks is the Nitinat group (Area 22) which includes a major hatchery on the Nitinat River. The net spawning escapement requirement for the Nitinat system totals 175,000, including 150,000 into the Nitinat River and 25,000 into other tributaries. Additional requirements for hatchery and test fishing may total up to 75,000. Therefore, the gross escapement requirement is 250,000 chum.

The management of this fishery is based on achieving the gross escapement requirement of 250,000 into the Nitinat watershed. Weekly escapement targets are set to ensure that all timing components of the run are represented. Weekly fisheries are scheduled in Area 21 and surrounding waters to harvest any identified surplus.

The fishing plan was based on providing early opportunities for gill net followed by a seine fishery to balance allocation and then a seine/gill net fishery at the peak of the run. Fisheries are dependent on reaching weekly escapement milestone levels into Nitinat Lake. Early season opportunities are constrained by concerns over Thompson River steelhead by-catch.

Gill net and seine vessels take part in the Nitinat area fishery. A gill net in-lake assessment fishery begins in late September. If weekly escapement targets are achieved and a further surplus is identified, then seines are allowed. Subsequent fisheries may open to both gear types, depending on achievement of the weekly escapement targets. A gill net test vessel, along with visual surveys of the river, is used to determine escapement into Nitinat Lake.

Since 1995, bycatch concerns at Nitinat have been addressed by delayed opening dates, reduced fishing area, increased use of weed lines, and species selective fishing techniques. In 1998, to minimize encounters of passing stocks of coho and Interior Fraser River steelhead, the first commercial gill net fishery was delayed until the beginning of October. In addition, the initial fishing area was reduced to within a one-mile boundary between lines true south from Pachena and Dare Points, based on information from the gill net test fishery. To reduce mortality of coho and steelhead and to improve the quality of catch data, the following measures were implemented for the entire season:

- non-retention of coho and steelhead (seine and gill net)
- mandatory functional revival tanks (seine and gill net)
- daylight fishing only (gill net)
- onboard observers (portions of seine and gill net fleet)
- logbooks and weekly hail-ins (seine and gill net)
- two-meter weed line for gill nets

In 2005, all measures continued to be implemented.

4.2 Catch, Escapement, and Run Size

Catch in Nitinat (Area 21) has traditionally occurred by gill net and seine (Table 6) outside the lake in marine areas. In the past, catch of non West Coast chum has occurred in the outside seaward portion of the fishing area. Management actions have been implemented to reduce this catch by restricting harvest closer to the terminal area. More recently, First Nations' harvests occurred within the lake (Area 22). Escapements of natural spawners have varied over the years (1996–2005) from a high of 435,000 to a low of 22,000.

Pre-season forecasts were based on escapement, survival of each year class and previous years' environmental factors. The pre-season forecast for 2005 return to Nitinat was 690,000 chum salmon.

Table 6. Nitinat area catch and escapement 1996–2005 (Areas 21 and 22).

Year	Area 21		Area 22	
	Seine Catch	Gillnet Catch	In-lake Catch & Broodstock	Natural Spawners
1996	268,000	75,000	122,000	343,000
1997	831,000	218,000	254,000	435,000
1998	537,000	157,000	410,000	192,000
1999	12,000	85,000	89,000	153,000
2000	2,000	7,000	11,000	22,000
2001	89,000	75,000	178,000	303,000
2002	466,000	81,000	383,000	40,000
2003	265,000	190,000	78,000	243,000
2004	72,000	156,000	166,000	250,000
2005	385,000	294,000	237,000	310,000
Average	293,000	134,000	193,000	229,000

4.3 2005 Nitinat Fishery Description

The gill net fishery at Nitinat opened on October 01. The gill net fishery was open every day except October 4, 16, and 17 until October 30. Fleet sized varied between 31 and 46 vessels until October 22. From October 23 until October 30 the fleet size ranged between 2 and 6 vessels. Gill net fishing throughout the first 3 weeks of the fishery was very good. The daily vessel average catch through this period was approximately 400 chum. The total gill net catch is estimated to be 294,000.

Seines opened on October 16 and October 17. 60 vessels participated in this opening. The fishery reopened on October 21 with 46 vessels participating and remained open until October 29. By October 24 only 6 vessels were fishing. The total seine catch is estimated to be 385,000 chum.

4.4 2005 Nootka/Tlupana Fishery Description

Gill nets fished two day per week in Outer Nootka Sound commencing September 20 until October 26. The fleet size averaged 31 vessels throughout the fishery. There was one fishery opening in Tlupana on October 14. The total gill net catch is estimated to be 84,000.

4.5 2005 Barkley Sound and Esperanza Inlet Assessment Fisheries

Small assessment fisheries were held in Barkley Sound and Esperanza Inlet again in 2005 to assess the feasibility of harvesting low levels of chums from areas that have not been fished for many years. A limited number of boats (maximum 8 in Barkley and 5 in Esperanza) were selected to fish 1 to 2 days, (some additional days were allowed in season in both areas), per week. Vessels fished in pre-determined zones on the first day with the remainder of the fleet free to fish in zones of their own selection. On the second or subsequent days all vessels were free to choose among the zones. Coho were allowed

to be retained. One onboard monitor was in each area each week. These fisheries started on September 27 and continued until October 26.

The Barkley Sound catch totaled approximately 12,000 chums and 201 coho while the Esperanza catch was estimated at 25,000 chum and 174 coho.

5. UNITED STATES STOCKS AND FISHERIES

5.1 Washington Run Sizes, Catches, and Spawning Escapements

Tables 7 through 9 provide the pre-season forecasts of run size, post-season estimates of spawning escapement and the total run size for the various chum salmon runs returning to Puget Sound and Coastal Washington areas. The tables provide estimates for three major groupings which are defined by their return timings (summer, fall, and winter chum).

Table 10 provides chum catch information from the Strait of Juan de Fuca (SJF) fisheries—Areas 4B, 5, and 6C and the San Juan Islands/Point Roberts (SJI/PR) fisheries—Areas 7 and 7A. The table also includes annual chum harvest totals for the Puget Sound and the Washington Coastal areas.

Paragraph 10 of the Chum Annex requires that Canada and the United States assess catch levels of summer chum salmon caught during the August 1 through September 15 time-period in boundary area fisheries. Table 11 provides chum catch during the summer chum management period for U.S. boundary area fisheries.

Table 7. Washington summer chum salmon pre-season and post-season estimates of abundance and estimated spawning escapements (1996–2005).

Region	Type	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Strait of Juan de Fuca	Pre-Season	2,440	1,338	1,310	869	792	941	1,468	3,131	4,739	6,803
	Post-Season	1,106	985	1,316	577	987	3,982	6,981	7,015	9,362	9,732
	Escapement	1,084	962	1,269	573	983	3,955	6,955	6,959	9,341	9,682
Hood Canal	Pre-Season	7,212	10,823	10,856	6,742	6,988	6,871	7,846	10,128	18,078	18,060
	Post-Season	21,056	9,373	4,274	4,527	9,506	13,375	13,170	36,328	88,644	16,099
	Escapement	20,490	8,972	4,001	4,114	8,649	12,044	11,454	35,696	69,995	15,757
South Puget Sound ¹	Pre-Season	79,551	69,634	149,950	121,039	84,867	75,599	155,000	47,788	99,317	38,334
	Post-Season	125,072	16,697	87,504	23,545	39,028	84,111	58,545	49,817	178,199	44,993
	Escapement	114,316	16,001	80,404	23,461	27,705	62,821	46,798	45,945	120,782	24,701

¹South Puget Sound does not include Canadian interceptions.

Table 8. Washington fall chum salmon pre-season and post-season estimates of abundance and estimated spawning escapements (1996–2005).

Region	Type	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Willapa Bay	Pre-Season	42,116	25,500	35,000	78,010	69,188	79,892	79,892	75,817	45,352	38,038
	Post-Season	22,499	34,112	76,714	26,409	46,991	53,384	92,334	85,283	32,022	28,275
	Escapement	20,011	33,286	65,092	24,751	40,030	29,623	59,750	47,347	17,115	11,924
Grays Harbor	Pre-Season	36,098	27,138	13,370	46,400	32,000	21,182	35,773	42,064	79,183	63,441
	Post-Season	16,881	14,071	37,161	15,198	10,432	26,049	39,997	48,652	103,658	20,397
	Escapement	12,413	13,456	35,188	12,260	8,942	24,898	31,405	37,947	73,828	13,058
Strait of Juan de Fuca	Pre-Season	5,177	4,720	3,130	3,029	2,823	1,841	1,761	2,494	2,438	3,460
	Post-Season	2,162	3,927	1,535	1,313	269	1,737	5,198	1,177	3,237	2,382
	Escapement	2,121	3,780	1,419	1,272	219	1,562	4,603	1,071	2,739	2,034
Nooksack Samish	Pre-Season	154,200	51,122	82,000	25,378	95,598	95,598	171,000	81,921	78,484	126,869
	Post-Season	69,900	55,000	149,600	94,000	18,878	131,412	109,591	133,464	89,850	64,496
	Escapement	51,889	22,222	89,206	34,594	5,244	75,919	86,284	112,683	53,563	44,512
Skagit	Pre-Season	302,841	62,418	186,000	59,345	168,000	45,000	304,049	52,410	109,715	25,695
	Post-Season	120,504	17,544	148,970	50,393	41,393	98,617	410,293	37,209	171,185	53,684
	Escapement	74,474	14,392	121,500	36,767	22,377	73,368	210,028	18,017	150,196	34,600
Stillaguamish/Snohomish	Pre-Season	234,598	244,707	338,331	151,012	184,867	113,600	685,100	245,246	264,542	225,113
	Post-Season	213,800	28,500	352,800	123,100	56,093	361,347	689,850	214,565	382,825	84,821
	Escapement	152,239	20,066	243,991	91,091	39,050	85,119	377,481	172,354	212,463	38,787
South Puget Sound	Pre-Season	926,459	380,111	500,000	662,000	402,000	214,000	241,500	448,365	470,048	655,742
	Post-Season	634,600	130,700	682,700	234,500	234,976	940,776	955,726	753,706	1,023,908	412,820
	Escapement	360,255	85,951	430,589	163,403	105,857	313,570	320,817	316,816	356,712	136,552
Hood Canal	Pre-Season	912,942	528,823	662,659	1,158,571	624,623	299,944	446,616	342,061	501,100	749,593
	Post-Season	821,100	456,000	575,300	147,300	153,346	793,359	898,754	1,272,657	1,194,733	345,701
	Escapement	409,523	125,302	244,354	87,095	62,931	255,371	370,840	333,118	231,758	98,761

Table 9. Washington winter chum salmon pre-season and post-season estimates of abundance and estimated spawning escapements (1996–2005)

Region	Type	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
South Puget Sound	Pre-Season	48,875	82,900	36,748	51,973	33,568	54,631	11,700	34,575	76,464	142,406
	Post-Season	29,862	13,099	77,885	17,579	11,323	158,380	219,205	53,507	134,003	72,739
	Escapement	24,103	9,271	76,676	15,691	8,524	139,046	206,468	50,050	98,579	43,917

Table 10. Catch of summer, fall, and winter chum salmon in SJF, SJI/PR, Puget Sound and Washington coastal areas (1996–2005).

Region	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
SJF	33,338	30,802	18,577	7,190	5,621	10,209	1,554	734	5,994	11,560
SJI/PR	90	248	40,939	79	433	3,247	111,976	81,613	166,170	77,536
Puget Sound ¹	748,254	385,311	752,685	236,235	280,506	1,457,426	1,837,633	1,469,146	1,936,236	645,420
WA Coast ²	18,812	3,106	29,911	12,552	23,333	26,383	41,642	49,738	47,500	23,811
Total	800,494	419,467	842,112	256,056	309,893	1,497,265	1,992,805	1,601,250	2,155,900	758,381

¹All other Puget Sound freshwater and marine catch reporting areas except Strait of Juan de Fuca or San Juan Islands Fisheries.

²Coastal Areas combine Catch and Reporting Areas 1–4 including Grays Harbor, Willapa Bay, and Columbia River.

Table 11. Catch of chum salmon in the Strait of Juan de Fuca and the San Juan Islands¹ commercial fisheries during the summer chum accounting period.

Periods: 95–97 GSI ²	7/1–8/11 ¹	8/12–8/18	8/19–8/25	8/26–9/1	9/2–9/8	9/9–9/15
	0.68	0.68	0.397	0.45	0.14	0.07
1996	24	65	4	0	0	0
1997	41	4	7	0	7	54
1998	44	16	1	0	0	0
1999	7	0	0	0	0	0
2000	11	2	0	0	0	0
2001	29	0	0	0	0	0
2002	44	0	0	0	0	0
2003	219	110	70	0	0	15
2004	149	15	0	15	31	25
2005	11	18	17	17	3	34

¹Indicates cumulative catch through this period.

²Proportion of Hood Canal/Strait of Juan de Fuca summer chum from GSI samples from 1995–1997.

5.2 U.S. Strait of Juan de Fuca Fisheries (Areas 4B, 5, 6C)

5.2.1 Management Intent

During the 2005 season the management strategy for the Strait of Juan de Fuca fishery has consisted of limiting the total effort in this fishery and keying management decisions on the needs of Puget Sound stocks of chum salmon. The regime of this fishery has been maintained by limiting access to four Treaty Indian tribes using only gillnet gear.

This fishery has been constrained by low catch rates, low market prices, and inclement weather conditions, resulting in relatively modest catch levels, which have had a decreasing trend over the period of 1996–2005 (Table 10). The catch in 2005 increased relative to recent years, however, catch was still below historical levels. This coupled with GSI information collected through 1996 indicates a decreasing level of interceptions of Canadian origin stocks.

5.2.2 2005 Fishery Description

As in previous years, the chum fishery in Areas 4B, 5, 6C was restricted to Treaty Indian gill net gear only. The fall chum fishery opened the week of October 9 and remained open 5 days per week through November 12.

Incidental catches of chum salmon occurred in fisheries for other species prior to the fall timed chum management period. A total of 59 chum salmon were taken prior to September 16 (during the summer chum accounting period). An additional 248 chum were harvested incidental to coho fisheries prior to the fall timed chum management period. There were 1,453 chum salmon harvested in chum fisheries after October 10; the total chum catch for 2005 was 1,760 (Table 10).

5.3 San Juan Islands/Point Roberts Fisheries (Areas 7 and 7A)

5.3.1 Management Intent

The U.S. fishery in Areas 7 and 7A was managed pursuant to the Commission guidance to the Southern Panel on the Management of Southern Chum Fisheries, (Attachment 2), which was a provisional modification to Annex IV, Chapter 6 Chum Annex) of the PST. The purpose of the document was to provide Commission direction to the Southern Panel on the conduct of southern chum salmon fisheries for the years 2004 to 2008. This direction was not intended to replace Annex IV, Chapter 6 of the Pacific Salmon Treaty. Additionally, the guidance document outlined certain modifications to the limits for the U.S. chum salmon fishery in Areas 7 and 7A, which disconnected the U.S. harvest limits from the harvest levels in the Johnstone Strait fishery. In summary, the guidance provided for the harvest limit of 130,000 chum salmon, unless Canada indicated that a critically low abundance condition was evident. The guidance document provided conditional actions in U.S. Areas 7 and 7A fisheries and reiterated a consistency with Chapter 6, provision 3(a)(ii) of the Annex identifying a catch ceiling of 20,000 given pre-season critical abundance.

The guidance document also included U.S. catch compensation due to the U.S. for harvest shortfalls from prior years, with the intent to eliminate the total accumulated catch difference by 2008. Consistent with Annex IV, Chapter 6, paragraph 5, the difference between actual catches and catch levels specified by this chapter is a total historical accumulated difference of 228,300 chum salmon, (accumulated from 1991 through 2003); the difference will be amortized over the years of the agreement described in the guidance. In 2005 the adjustment amount was 46,000 (Table 12).

The guidance document also provided that U.S. fisheries, for chum salmon, may start in these areas no earlier than October 10. It also provided for management responses in the U.S. Areas 7 and 7A fisheries, when inseason estimates indicated a low abundance (less than 900,000 fish) entering the Fraser River.

Table 12. Summary of U.S. Areas 7 and 7A limits and catches in 2005.

Year	PSC Guidance Specified Limit	Adjusted Limit	Actual Catch	Annual Overage or Shortfall	Accumulated Balance Due	Total Balance Due
2003			81,613	0	228,300 ¹	228,300
2004	130,000	176,000 ¹	166,170	0	182,300	182,300
2005	130,000	176,000 ¹	77,536	15,000 ²	136,300	151,300

¹The adjusted catch limit includes a portion (46,000) of the amount that was due to the U.S. That amount is subtracted from the total accumulated difference, whether actually harvested or not.

²This value is identified in the Commission's guidance document to the Southern Panel (Attachment 2).

Paragraph 3 of the Chum Annex also provides for the U.S. to manage its fishery to maintain a traditional proportion of the catch between Areas 7 and 7A and to avoid concentrations of effort along the international boundary in Area 7A. There have been only five years with a significant fishery during this time-period and the percentage of the catch in Area 7A ranged from 23.8% to 53.4% (Table 13). Historically, the catch had been distributed approximately 50/50 between the two areas.

Table 13. Distribution of catch between areas 7 and 7A (1996–2005).

Catch Area	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
7	1	97	30,913	0	430	2,241	69,475	39,990	77,412	56,904
7A	89	151	9,634	79	2	1,006	42,501	41,642	88,758	20,632
% in 7A	*	*	23.8%	*	*	*	38.0%	51.0%	53.4%	26.6%

*Non-fishing years; primarily incidental catches.

5.3.2 2005 Fishery Description

Preseason forecasts were for a good return of fall chum in Puget Sound. Inseason updates of abundance indicated that numerous runs were significantly more abundant than the preseason forecast. The harvest level for Areas 7 and 7A, as specified in the 2004 agreement (Commission guidance to the Southern Panel on the management of southern chum fisheries [February 13, 2004], Attachment 2), was 130,000 chum salmon plus an adjustment of 46,000 chum salmon from previous U.S. harvest shortfalls for a total target catch of 176,000 chum salmon. No specific forecast or inseason abundance estimates were available for overall Canadian Inside chum stock but Canada indicated the run size was not at a critically low level. During the season, Canada provided an updated estimate of 1.6 million chum for the Fraser River and under the terms of the guidance, fisheries proceeded as planned.

Non-Treaty reef net fisheries continued after the end of Fraser Panel control and fished through the chum management period until the end of November. After the Panel's

release of control for this area and prior to October 1, this fishery required the release of all Chinook, sockeye, chum, and unmarked coho. After October 1, retention of chum and marked coho were allowed.

For the week beginning October 9, the Treaty Indian gill net and purse seine fishery was opened for a one-day fishery on October 10–11 with an area restriction in Haro Strait for coho conservation. Following the one-day fishery the coho composition was assessed and was less than 15% which then allowed 2 additional days of fishing on October 14 and 15 following the Non-Treaty fishery. A Non-Treaty gill net and purse seine fishery followed with two days of gill net and purse seine fishing on October 12 and 13.

For the week beginning October 16, the Treaty Indian gill net and purse seine fishery was open for three days from October 16 through October 18 with the Haro Strait area restriction removed. The Treaty fishery reopened for two days, October 21 through October 22 after the Non-Treaty fishery. The Non-Treaty gill net and purse seine fishery was open two days from October 19 through October 20 with coho and Chinook release.

For the week of October 23 the Treaty Indian gill net and purse seine fishery reopened on October 23 and remained open until the end of November 19. The Non-Treaty gill net and purse seine fishery opened two days on October 26 and 27 with coho and Chinook release.

For the weeks of October 30 and November 6, the Non-Treaty gill net and purse seine fishery opened five days a week; October 31 through November 4 and November 7 through November 11, with coho and Chinook release.

Catches during first week of the chum fishery were less than expected (36,000) given the U.S. share and most of the effort dropped off after the third week of the fishery (25,000 and 13,000 catches by week respectively). Much of the effort after the forth week of the fishery was for personal use. Despite Chum prices improving, large abundances of chum were not in evidence in 7 and 7A, and resulted in the fishery falling short of its quota in 2005 by 56% (Table 12).

There were 59 summer timed chum reported caught in Areas 7 and 7A prior to September 16. These fish were caught incidental to sockeye fisheries. There were 5280 chum harvest during the September 16 to October 10 time period. The total chum catch by all gears in Areas 7 and 7A was 77,536.

6. STOCK IDENTIFICATION

6.1. Tagging of Adult Chum Salmon

No tagging projects were reported by either United States or Canada in 2005.

6.2 Coded Wire Tagging, Otolith Marking, and Fin Clipping

United States

A summer chum salmon supplementation program was started in 1992 at the Quilcene National Fish Hatchery to address severe declines in the numbers of summer chum returning to the Quilcene River and Hood Canal. The first brood (1992) was coded wire tagged to evaluate summer chum returns and fishery distributions in marine fisheries. Concerns over the physical impacts of tagging small fish, and limited sampling for tags in chum fisheries, led to the discontinuation of the CWT effort. In recent years, an adipose-only clip was utilized to aid in identifying hatchery fish for terminal fisheries management and project evaluation purposes. Brood year 2003 was the final year summer chum were marked and released from the hatchery.

A number of other hatchery supplementation and reintroduction programs for summer chum in the Hood Canal and Strait of Juan de Fuca regions, and fall chum in the Lower Columbia have utilized otolith marks to aid in assessing the success of the programs and to determine the proportion of hatchery and natural origin fish on the spawning grounds (Table 14). Supplementation summer chum releases for recovery ended at Discovery, Chimacum, and Union with brood year 2003.

Table 14. Numbers of summer and fall chum salmon released with otolith marks, by brood year and location (1999–2005).

Brood Year	Puget Sound Summer Run							
	Sequim	Discovery Bay	Chimacum	Big Beef	Hamma Hamma	Lilliwaup	Union	Tahuya
1999	3,880	34,680	39,170	39,800	31,600	17,400		
2000	25,900	90,435	73,300	80,550	55,400	14,800	75,876	
2001	54,515	90,980	79,500	80,925	49,500	38,000	73,472	
2002	20,887	118,347	57,300	72,622	61,000	96,000	82,636	
2003	49,142	88,610	57,435	76,353	75,356	103,913	35,343	111,232
2004	76,982	1	1	14,814	57,000	99,500	1	118,872
2005	57,300			5,685	117,837	106,466		119,260
Lower Columbia Fall Run								
	Grays River Hatchery		Sea Resources Hatchery			Wasbougal Hatchery		
1999	134,661		62,820					
2000	202,833		74,512					
2001	305,185		0					
2002	398,000		84,818			218,283		
2003	357,000		102,132			75,952		
2004	163,000		0			0		
2005	155,501		0			19,578		

¹Program discontinued after brood year 2003.

Canada

Thermal marking has been used as a technique of mass marking hatchery raised salmonids in B.C. since 1992. The method involves manipulating the temperature of the rearing water by at least 2°C to induce a mark on the otolith. The change in water temperature can be accomplished through the use of two different water sources, through heating the water or by chilling it. By altering water temperatures over a period of time a unique mark can be created.

Thermal marking was first used on chum from Nitinat hatchery in 1993 and continues to be used as a means of estimating hatchery contribution to both fisheries and escapement (Table 15). Thermal marking is currently the only method of marking being applied to chum from Nitinat hatchery (due to the dropping of the Multiple Fin Clip program). Transplanting thermally marked chum into Klanawa River began with the 2001 brood year in an attempt to help re-establish that stock.

Conuma Hatchery first began thermal marking several stocks with the 1998 brood year. The first return year for which all hatchery fish will be thermally marked was 2003. A comprehensive sampling program occurred during the fall chum fisheries and permitted a better understanding of timing and distribution of the different stocks in Nootka Sound.

Enhanced contributions of chum from major hatchery facilities are based on marking a portion of the fry released with an adipose clip and coded-wire tag (Ad-cwt) or a ventral finclip with or without an adipose clip, and subsequent recovery of these marks in the commercial fishery and escapement programs. Marked fry are enumerated individually at marking. Released chum marked with finclips include the Big Qualicum River (since 1964) and Little Qualicum River (since 1979), the Chilliwack River (1980–1997), the Nitinat River (since 1980), Pallant Creek (since 1978), and Conuma River (since 1978). Released chum marked with adipose clips (Ad) and coded-wire-tags (CWTs) include the Puntledge River (since 1980), Chehalis River (1983–1998), Inch Creek (1978–2001), and Stave River (1982–1997). Unmarked fry represented by the mark are enumerated by subtracting egg and fry mortalities from the egg number which is usually calculated using electronic egg counters. Since egg and fry mortality generally is less than 10%, fry enumeration is considered very accurate. Not all release groups are represented by a mark. Contributions for those groups are estimated by associating them with a marked release group with a similar size and release timing. Tables 16 and 17 provide a summary of marks applied from 1999–2005.

Table 15. WCVI Chum Thermal Marks in British Columbia, 1999–2005.

Brood Year	Hatchery Facility							
	Nitinat Release Sites				Comuma Release Sites			
	Nitinat River & Lake	Klanawa River	Comuma River	Comuma Estuary	Tlupana River	Sucowa River	Canton River	Deserted River
1999	23,721,507		525,964	1,369,785	1,103,714	1,883,722	1,071,147	1,822,476
2000	5,153,902		543,511	1,296,654	998,400	139,090	1,009,746	269,284
2001	27,093,836	3,162,846	569,118	1,649,290	390,754	200,803	1,070,539	272,395
2002	22,757,842	2,915,502		1,792,758	1,038,542	445,007	892,140	341,635
2003	21,252,421	2,516,338		1,585,534	425,261	410,872	484,570	798,330
2004	32,684,608	2,631,539		1,882,230	932,556	1,023,658	679,554	
2005	36,724,205	2,739,742		914,381	744,834	256,296	434,449	

Table 16. Chum Salmon Tagged (CWT+Adipose clip) and Released from Southern based Canadian hatchery facilities from 1999–2005.

Stock	Brood Year	CWT+Adipose clip	Adipose clip	Unclipped
Inch Creek	1999	49,826	98	952,769
	2000	49,759	264	926,658
	2001	49,931	100	1,124,599
Sliammon River	1999	100,053	0	505,633
	2000	99,615	879	500,628

Table 17. West Coast Chum salmon fin clipped at southern Canadian hatchery facilities (AD: adipose; LV: left ventral; RV: right ventral; AN: anal; D: dorsal), 1999–2005.

Stock	Brood Year	Clip Type	# Clipped	# Poor Clips/Unclipped
Big Qualicum River	1999	ADRV	250,225	5,014
	2001	ADRV	245,794	8,596
	2002	ADRV	252,260	10,359
	2003	ADRV	251,939	4,856
	2004	ADRV	261,366	6,579
Comuma River	1999	ADLV	99,225	8,549
	2000	ADLV	97,906	4,720
	2001	ADLV	102,059	4,018
Deserted/NWVI	1999	RV	75,043	4,560
	2000	RV	76,928	1,174
Fish+Airport	1999	LV	105,045	1,061
	2000	LV	83,328	17,018
Hirsch Creek	1999	LV	100,161	742
	2000	LV	101,947	0
Kitasoo Creek	1999	LV	112,358	2,125
	1999	RV	81,874	4,589
Kitimat River	1999	RV	100,102	900
	2000	RV	99,732	0
Little Qualicum River	1999	ADLV	251,600	4,129
	2001	ADLV	266,330	7,874
	2002	ADLV	249,887	120
Salloomt River	2001	LV	97,015	4,595
	2002	LV	100,637	4,742
	2003	LV	103,148	1,054
Theodosia River	2002	LV	101,029	0
Snootli Creek	1999	RV	106,211	0
	2000	RV	89,302	12,190
	2001	RV	98,675	5,193
	2002	RV	99,718	5,804
Sucwoa River	1999	LV	76,297	715
	2000	LV	76,400	0
	2001	LV	76,516	0
Sugsw Creek	2000	LV	13,000	0
	2001	LV	31,000	0
	2002	LV	11,000	0
	2003	LV	11,000	0
	2004	LV	20,600	0

6.4 Genetic Stock Identification

United States

In 2005, 837 DNA tissue samples were collected from 11/2/2005 through 11/18/2005 in the Puget Sound Area 9, (Washington State mixed stock fishing area), test fishery as the first year of an on-going study. Work also continued in Puget Sound on specific project areas. One such project was the continuing work of the Tulalip Tribes on genetically

marked fall chum salmon. Another project, by WDFW, focused on the interrelationships of summer chum salmon—currently listed as threatened, under provisions of the United States' ESA (Kassler and Shaklee, 2003).

The Tulalip Tribes continued to assess the persistence of genetically marked fall chum salmon, from the Tulalip Hatchery, based on selection from brood years 1990 through 1993. This work, while it confirmed the persistence of the marks (allelic frequencies at mIDHP-1 and mMEP-2), initially established to serve as indices in U.S. and Canadian fisheries, focused on the persistence and variation of this population's entry pattern, as well as straying frequency and distribution. To this endeavor, samples were collected from adults, in fisheries and spawning grounds, as well as emigrating juveniles, from nearshore marine areas (Rawson, 2005).

WDFW used genetic techniques to clarify otolith marking data in the monitoring of Hood Canal summer chum supplementation projects. All returning supplementation-origin summer chum were otolith-marked, but there was ambiguity between marks for some programs, meaning that fish could be identified as supplementation or natural-origin, but some supplementation fish could not be identified to their program of origin. Where possible, analysis of DNA samples from fish with ambiguous marks was used to identify fish to the program of origin.

Canada

There were no GSI collections made in Directed chum fisheries in Canada in 2005. A summary of historic chum GSI sampling is presented in Table 18.

Table 18. Number of chum salmon sampled for GSI data, 1996–2005.

Year	Commercial Samples			Test Fishery Samples		
	Johnstone Strait	Qualicum	Nitinat	Johnstone Strait	Qualicum	Nitinat
1996	0	0	0	1,795	0	0
1997	0	0	0	0	0	0
1998	150	0	0	150	0	0
1999	0	0	0	0	0	0
2000	300	0	0	0	0	0
2001	300	0	0	0	0	0
2002	0	0	0	0	0	0
2003	600	0	0	100	0	0
2004	600	0	0	0	0	0
2005	0	0	0	0	0	0

6.4.1 Baseline Collection for DNA Stock Identification.

In 2005 WDFW continued its baseline sampling of relevant Washington State populations of adult chum salmon (Table 19). Fin tissues were clipped and stored in alcohol for future analyses of DNA-based genetic variability.

6.4.2 Microsatellite DNA (mSAT) standardization.

Current Research: Genetic Stock ID work: Two one-year contracts were let to CDFO and WDFW to develop a standardized set of mSAT loci and procedures for chum salmon (Beacham et al. 2005). Fifteen loci were identified for which concordance in allele scoring between the laboratories was 99% (Table 20, column A). Research was funded by the Southern Boundary Research and Enhancement Fund 2004-2005. Contacts: Terry Beacham, PBS and Sewall Young, WDFW.

Table 19. Chum salmon genetics tissue collections from Washington in 2005 (T. Johnson et al. 2005).

Collection Code	Run Timing	2005 Collection Name	Number of Samples
05IH	SU	Jimmycomelately Creek	63
05II	SU	Salmon Creek	11
05IK	SU	Chimacum Creek	1
NMFS	SU	Quilcene Bay	104
05IM	SU	Dosewallips River	113
05IN	SU	Duckabush River	55
05IR	SU	Union River	107
05IO	SU	Hamma Hamma River	246
05IP	SU	Lilliwaup River	192
*	SU	Skokomish River	1
05IQ	SU	Big Beef Creek	38
Summer Run Total			931
05MT	F	Pysht River	144
05LY	F	Dewatto River	3
05NM	F	Skokomish River	2
05KG	F	Crazy Johnson Creek	34
05KG	F	Grays River	29
05KV	F	Hamilton Creek	99
05KW	F	Hamilton Creek Spring Channel	81
05KX	F	Hardy Creek	65
05KG	F	West Fork Grays River	37
05KJ	F	Duncan Creek Channel	46
05KM	F	Abernathy Creek	1
05KN	F	East Fork Lewis River	1
05KO	F	Elochoman River/Beaver Creek	4
05LD	F	Horsetail Falls	12
05KZ	F	Ives Island	100
05KY	F	Multnomah Falls Area	47
05KR	F	North Fork Lewis River	5
05LA/05LB	F	Rivershore	49
05KS	F	Skamokawa Creek	15
05LC	F	St. Cloud Area	29
05LB/05LA	F	Wood's Landing/Rivershore	51
05KU	F	Bonneville Dam (AFF)	1
05HU	F	Cowlitz River Salmon Hatchery	13
05KF	F	Elochomin Hatchery	4
05LV	F	Grays River Hatchery	132
05KF	F	Sea Resource Hatchery	249
05KK	F	Washougal Hatchery (brood collection)	20
05LE	F	Big Creek Hatchery (OR)	9
Fall Run Total			1,282
TOTAL			2,213

Table 20. List of mSAT loci used in two separate chum salmon surveys—bolded mSAT loci are those loci used in both surveys.

A. Beacham et al.	B. NWFSC unpublished
Oke3	
Oki2	Okil
Oki100	
One102	One102
One114	One114
	One18
	Otsg311
Omm1070	
Omy1011	Omy1011
One103	
One104	
	One108
One111	One111
Ots103	Ots103
	Ots2m
Ots3m	Ots3m
Otsg68	
One101	One101
	One106
Ssa419	Ssa419

6.4.3 Forensic use of mSATs in Puget Sound.

Data for 14 mSAT loci were generated to evaluate differences between fall- and summer-run chum salmon stocks in Puget Sound (see Table 21, col. B). Clear differences between the two groups were detected (Figure 1). Eight loci in this study were common to the Beacham et al. 2005 report (see Table 21, columns A & B). Ref: unpublished data, NWFSC. Contacts: P. Schwenke and G. Winans. Gary.Winans@NOAA.gov. See also Small and Young, 2003.

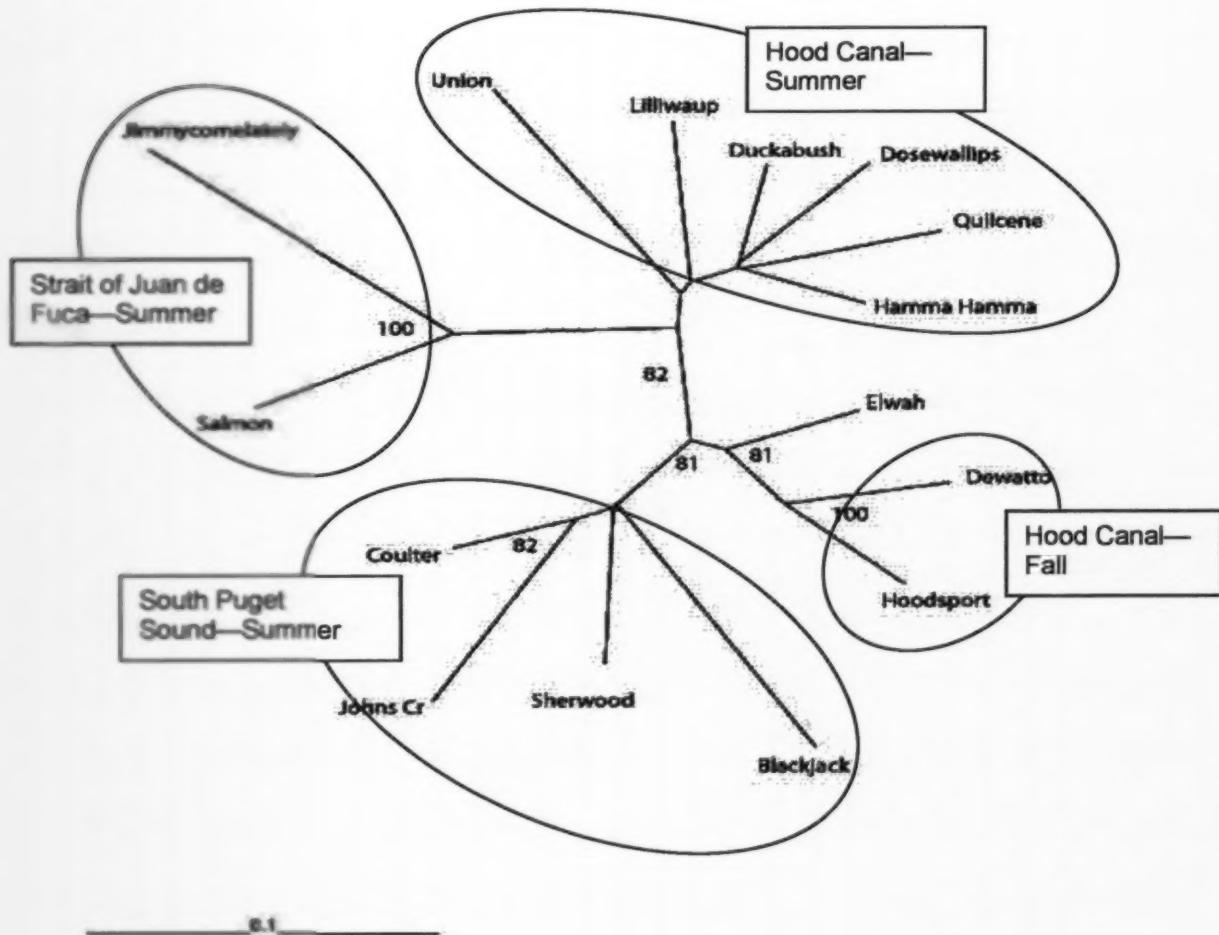


Figure 1. Puget Sound chum salmon relationships based on 14 mSAT loci (unpublished data, NWFSC, Seattle, WA).

4.2.4 Single Nucleotide Polymorphisms (SNPs) markers.

United States

A Pacific Rim survey was reported this year that evaluated genetic variation at 31 SNPs loci (Seeb et al. 2005). Several Washington-state collections were included in the study; no B.C. stocks were made available. Substantial differences were seen between fall- and summer-run stocks in Puget Sound (Attachment 4). Loci are listed in Table 21; stocks included in the analysis are included in Table 22. Contacts: Lisa Seeb, Lisa_Seeb@fishgame.state.ak.us

Table 21. Mitochondrial (mtDNA) and nuclear single nucleotide polymorphisms assayed in chum salmon. Sources describing each SNP giving conditions for genotyping via the 5'-nuclease reaction are given. Source references: SNP loci from Seeb et al. 2005.

Assay	Locus	Source
mtDNA SNPs	<i>Oke_Cr231</i>	Sato et al. 2001; Smith et al. 2005a
	<i>Oke_Cr30</i>	Sato et al. 2001; Smith et al. 2005a
	<i>Oke_Cr386</i>	Sato et al. 2001; Smith et al. 2005a
	<i>Oke_Cr42</i>	Sato et al. 2004
	<i>Oke_Cr96</i>	Sato et al. 2004
	<i>Oke_ND3-69</i>	Smith et al. 2005a
nuclear SNPs	<i>Oke_arf-31</i>	Smith et al. 2005b
	<i>Oke_BAMBI-116</i>	Smith et al. 2005b
	<i>Oke_CKS_2-389</i>	Smith et al. 2005a
	<i>Oke_copa-211</i>	Smith et al. 2005b
	<i>Oke_DM20-548</i>	Smith et al. 2005a
	<i>Oke_eif4ebp2-64</i>	Smith et al. 2005b
	<i>Oke_GHII-2943</i>	Unpublished
	<i>Oke_GHII-3129</i>	Unpublished
	<i>Oke_GnRH_3-373</i>	Smith et al. 2005b
	<i>Oke_GnRH-527</i>	Smith et al. 2005b
	<i>Oke_GPDH-191</i>	Smith et al. 2005b
	<i>Oke_HGFA-319</i>	Smith et al. 2005b
	<i>Oke_hsc71-199</i>	Smith et al. 2005b
	<i>Oke_il-1racp-67</i>	Smith et al. 2005b
	<i>Oke_IL8r2-406</i>	Smith et al. 2005b
	<i>Oke_IL8r-272</i>	Smith et al. 2005b
	<i>Oke_Moesin160</i>	Smith et al. 2005b
	<i>Oke_rasl-426</i>	Unpublished
	<i>Oke_RFC2-618</i>	Smith et al. 2005b
	<i>Oke_RH1op-245</i>	Smith et al. 2005b
	<i>Oke_SClkF2R2-239</i>	Smith et al. 2005b
	<i>Oke_serp1n40</i>	Smith et al. 2005b
	<i>Oke_Tsha1-196</i>	Smith et al. 2005b
	<i>Oke_ul-519</i>	Smith et al. 2005a
	<i>Oke_u202-131</i>	Smith et al. 2005b
	<i>Oke_u212-87</i>	Smith et al. 2005b
	<i>Oke_u216-222</i>	Smith et al. 2005b
	<i>Oke_u217-172</i>	Smith et al. 2005b
	<i>Oke_u200-385</i>	Smith et al. 2005b
	<i>Oke_Zp3b-314</i>	Smith et al. 2005b

Table 22. Washington Stocks and number of fish included in SNP analysis.

Location	Fish Samples	Stock
Big Mission Creek	11	Fall
Dewatto River	16	Fall
Elwha River	95	Fall
Hoodsport	16	Fall
Nisqually River	95	Fall
Hamma River	16	Summer
Quilcene	16	Summer
Union River	16	Summer

Canada

Canadian tissue samples for DNA analysis have been collected over a number of years (Table 23). Early DNA work consisted of experimental work on identifying appropriate markers for stock separation. Samples continue to be collected to provide a complete baseline for southern British Columbia Inside chum stocks. No samples were collected in 2005.

Table 23. Chum sample tissue collection from southern British Columbia (through 2005), sample sizes greater than, or equal to 50.

Population Name	Collection Year(s)	Sample Size
Ahnuhati	2004, 2005	164
Algard	2003	99
Alouette North	2004	57
Campbell River	2002	188
Cayeghle	2002, 2003, 2004	137
Cheakamus	1992, 2002, 2003	120
Chehalis	1991, 1992	96
Chemainus	1992, 1997	161
Chilliwack	1992, 2004	198
Chilqua Creek	2004, 2005	202
Cold Creek	2002	191
Colonial	2002	211
Cowichan	1997 1999, 2000	397
Cowichan Lake	2002	54
Demaniel	1992	50
Glendale	2003	94
Goldstream	1991, 1992, 1997, 1999	281
Goodspeed River	2002, 2004	194
Harrison	2002	200
Heydon Creek	1998, 2001, 2003	250
Homathko River	2004	204
Inch Creek	2002, 2003	404
Indian River	2000, 2002	344
Kanaka Creek	2004, 2005	141
Kawkawa	2004	65
Klinaklimi	1997, 2002	116
Lower Lillooet	2002	124
Mamquam	1991 2002	107
Nanaimo	1991, 1997, 2001, 2002	245
Nimpkish	2002, 2004	418
Nitinat	1992	50
Norish/Worth	2004	209
Orford	2003	103
Pegattum Creek	2002	67
Puntledge	1991	50
Sliammon	1991	50
Silverdale	2000, 2004, 2005	164
Smith Creek	1997	95
Southgate	2003, 2004	223
Squakum	2000, 2004, 2005	272
Squamish	2002, 2003	85
Stave	1991, 2003	244
Theodosia	2002	145
Tzoonie	1991	50
Vedder	2002, 2003	75
Viner Sound	2002, 2003	205
Wahleach	1991	50
Widgeon Slough	2004	191
Worth Creek	2005	108
Wortley Creek	2002	242

REFERENCES

Beacham, T.D., M.H. Wetklo, D.K. Hawkins, and S.F. Young. 2005. Development of a standardized suite of microsatellite loci to be used in the establishment of a chum salmon baseline for southern British Columbia and Washington. Project report. June 2005. 35 pp.

Gazey, W.J. and R.V. Palermo. 2000. A preliminary review of a new model based on test fishing data analysis to measure abundance of returning chum stocks to the Fraser River. DFO Canadian Stock Assessment Secretariat Research Document 2000/159. 30 pp.
http://www.dfo-mpo.gc.ca/csas/Csas/English/Research_Years/2000/2000_159E.htm.

Johnson, T., J. Ames, K. Adicks, C. Weller, N. Lampsakis. 2006. 2005 progress report on Hood Canal and Strait of Juan de Fuca summer chum salmon. Unpublished memorandum report, WDFW and PNPTC.

Kassler, T. and J. Shaklee. 2003. An Analysis of the Genetic Characteristics and Interrelationships of Summer Chum in Hood Canal and Strait of Juan de Fuca and of Chum in Curley Creek (Puget Sound) Using Allozyme Data. *In:* Summer Chum Salmon Conservation Initiative; Supplemental Report No. 4. Washington Department of Fish and Wildlife and Point No Point Treaty Tribes. *In:*
<http://wdfw.wa.gov/fish/chum/chumsupp4.pdf>.

Rawson, K. 2005. Initial results 2002, 2003 (adult) and 2003 (fry) chum GSI collections. Tulalip Tribes Unpublished Report, Tulalip, Washington, 98271.

Ryall, P., C. Murray, V. Palermo, D. Bailey, and D. Chen. 1999. Status of clockwork chum salmon stock and review of the Clockwork Management Strategy. DFO Canadian Stock Assessment Secretariat Research Document 99/169. 134 pp. http://www.dfo-mpo.gc.ca/csas/Csas/English/Research_Years/1999/a99_169e.htm.

Sato SJ, Ando H, Ando S, Urawa S, Urano A, Abe S. 2001. Genetic variation among Japanese populations of chum salmon inferred from nucleotide DNA control region. *Zoological Science*, 18, 99–106.

Sato, S., H. Kojima, J. Ando, H. Ando, R. L. Wilmot, L. W. Seeb, V. Efremov, L. Leclair, W. Buchholz, D. H. Jin, S. Urawa, M. Kaeriyama, A. Urano, and S. Abe. 2004. Genetic population structure of chum salmon in the Pacific Rim inferred from mitochondrial DNA sequence variation. *Environmental Biology of Fishes* 69: 37–50.

Seeb L.W., W.D. Templin, C.T. Smith, C. Elfstrom, S. Urawa, R.L. Wilmot, and J.E. Seeb. 2005. SNPs provide an easily-standardized baseline for NPAFC studies of chum salmon. (NPAFC Doc. 907) 12 pages. Alaska Department of Fish and Game, 333 Raspberry Road, Anchorage, AK, USA 99518. Contacts: Lisa Seeb, Lisa_Seeb@fishgame.state.ak.us.

Small, Maureen P. and Sewall P. Young. 2003. A Genetic Analysis of Summer and Fall Chum Salmon Populations in Hood Canal, Strait of Juan de Fuca, and South Puget Sound Using Microsatellite Data. *In: Summer Chum Salmon Conservation Initiative, Supplemental Report No. 4. Washington Department of Fish and Wildlife and Point No Point Treaty Tribes. In: <http://wdfw.wa.gov/fish/chum/chumsupp4.pdf>.*

Smith, C. T., J. Baker, L. Park, L. W. Seeb, C. Elfstrom, S. Abe, and J. E. Seeb. 2005a. Characterization of 13 single nucleotide polymorphism markers for chum salmon. *Molecular Ecology Notes* 5: 259–262.

Smith, C. T., Elfstrom, C. M., Seeb, J. E., and Seeb, L. W. 2005b. Use of sequence data from rainbow trout and Atlantic salmon for SNP detection in Pacific salmon. *Molecular Ecology* 14 4193–4203.

ATTACHMENT 1:

ANNEX IV, CHAPTER 6, OF THE PACIFIC SALMON TREATY

Chapter 6:
Southern British Columbia and Washington State Chum Salmon

The provisions of this Chapter shall apply for the period 1999 through 2008.

1. The Parties shall maintain a joint Chum Technical Committee ("the Committee") reporting, unless otherwise agreed, to the Southern Panel and the Commission. The Committee will undertake to, *inter alia*:

- (a) identify and review the status of stocks of primary concern;
- (b) present the most current information on harvest rates and patterns on these stocks, and develop a joint database for assessments;
- (c) collate available information on the productivity of chum stocks to identify escapements which produce maximum sustainable harvests and allowable harvest rates;
- (d) present historical catch data, associated fishing regimes, and information on stock composition in fisheries harvesting those stocks;
- (e) devise analytical methods for the development of alternative regulatory and production strategies;
- (f) identify information and research needs, to include future monitoring programs for stock assessment; and
- (g) for each season, make stock and fishery assessments and evaluate the effectiveness of management.

2. In the years 1999 through 2008, Canada will manage its Johnstone Strait, Strait of Georgia, and Fraser River chum fisheries to provide continued rebuilding of depressed naturally spawning chum stocks, and, to the extent practicable, minimize increased interceptions of United States origin chum. Terminal fisheries conducted on specific stocks with identified surpluses will be managed to minimize interception of non-targeted stocks.

3. In the years 1999 through 2008,

- a) for Johnstone Strait run sizes less than 3.0 million

(i) Canada, taking into account the catch of Canadian chum in United States Areas 7 and 7A, will limit its harvest rate in Johnstone Strait to less than 10 percent, resulting in a Johnstone Strait catch level of up to 280,000 chum; and

(ii) when the catch in Johnstone Strait is 280,000 chum or less, the United States catch of chum in Areas 7 and 7A shall be limited to chum taken incidentally to other species and in other minor fisheries, but shall not exceed 20,000, provided, however, that catches for the purposes of electrophoretic sampling shall not be included in the aforementioned limit;

(b) for Johnstone Strait run sizes from 3.0 million to 3.9 million

(i) Canada, taking into account the catch of Canadian chum in United States Areas 7 and 7A, will limit its harvest rate in Johnstone Strait to 20 percent, resulting in a Johnstone Strait catch level of 280,000 to 745,000 chum; and

(ii) when the catch in Johnstone Strait is from 280,000 to 745,000 chum, the United States catch of chum in Areas 7 and 7A shall not exceed 120,000;

(c) for Johnstone Strait run sizes of 3.9 million and greater

(i) Canada, taking into account the catch of Canadian chum in United States Areas 7 and 7A, will harvest at a rate in Johnstone Strait of 30 percent or greater, resulting in a Johnstone Strait catch level of 745,000 chum or greater; and

(ii) when the catch in Johnstone Strait is 745,000 chum or greater, the United States catch of chum in Areas 7 and 7A shall not exceed 140,000;

(d) it is understood that the Johnstone Strait run sizes, harvest rates, and catch levels referred to in 3(a), 3(b), and 3(c) are those determined in season, in Johnstone Strait, by Canada; and

(e) the United States shall manage in a manner that, as far as practicable, maintains a traditional proportion of effort and catch between United States Areas 7 and 7A, and avoids concentrations of effort along the boundary in Area 7A.

4. In the years 1999 through 2008, the United States shall conduct its chum fishery in the Strait of Juan de Fuca (United States Areas 4B, 5 and 6C) so as to maintain the limited effort nature of this fishery, and, to the extent practicable, minimize increased interceptions of Canadian origin chum. The United States shall continue to monitor this fishery to determine if recent catch levels indicate an increasing level of interception.
5. If, in any year, the United States chum fishery in Areas 7 and 7A fails to achieve the catch levels specified in paragraphs 3(a)(ii), 3(b)(ii) and 3(c)(ii), any differences shall be compensated by adjustments to the Areas 7 and 7A fishery in subsequent years, except that chum catches below the level specified in paragraph 3(a)(ii) shall not be compensated.
6. Catch compositions in fisheries covered by this Chapter will be estimated by post-season analysis using methods agreed upon by the Committee.
7. Canada will manage the Nitinat net chum fishery to minimize the harvest of non-targeted stocks.
8. In the years 1999 through 2008, Canada shall conduct electrophoretic sampling of chum taken in the West Coast Vancouver Island troll fishery if early-season catch information indicates that catch totals for the season may reach levels similar to 1985 and 1986. Sampling, should it occur, will include catches taken from the southern areas (Canadian Areas 121-124).
9. During the period of August 1 through September 15 of each year, Canada will require the live release of chum salmon from all purse seine gear fishing in the Strait of Juan de Fuca (Canadian Area 20) and the United States will require the same for non-Indian seine fisheries in Areas 7 and 7A. Note: purse seine fisheries are not permitted in U.S. Areas 4B, 5 and 6C.
10. Canada and the United States shall assess catch levels and make attempts to collect additional genetic samples from any chum salmon caught during the August 1 through September 15 time period in the boundary area fisheries (U.S. Areas 4B, 5, 6C, 7 and 7A; Canadian Areas 18, 19, 20, 21 and 29).

ATTACHMENT 2:

COMMISSION GUIDANCE TO THE SOUTHERN PANEL ON THE
MANAGEMENT OF SOUTHERN CHUM FISHERIES (FEBRUARY 13, 2004)

The purpose of this document is to provide Commission direction to the Southern Panel on the conduct of southern chum salmon fisheries for the years 2004 to 2008. This direction is not intended to replace Annex IV, Chapter 6 of the Pacific Salmon Treaty.

Johnstone Strait

For run sizes above the critical level of 800K–1.5M, Canada will conduct fisheries with a combined exploitation rate of up to 20% in Johnstone Strait. The Johnstone Strait Canadian commercial fisheries will follow a pre-season plan designed with a fixed fishing schedule to achieve a maximum of 15% exploitation rate.

For run sizes below the critical level, Canada will reduce its exploitation rate. Under a critical level run size, Canada will conduct assessment fisheries and other commercial fisheries will be suspended.

Fraser River

For Fraser River terminal fisheries, with an identified run size under 900,000 the Canadian commercial fishery will not occur within the Fraser River (Area 29). For run sizes greater than 900,000 Canadian commercial fisheries will likely not occur prior to October 22.

Agreement on Modification to the Limits for the U.S. Chum Salmon Fishery

1. Catch Ceiling

- (a) If a critical abundance level, as provided by Canada, of inside southern bound chum stocks is not identified, the base catch ceiling for the U.S. Areas 7 and 7A chum fisheries will be 130,000 chum.
- (b) If a pre-season critical abundance level forecast of inside southern bound chum stocks is expected and/or the first Canadian Johnstone Strait commercial seine fishery identifies this level, the U.S. catch of chum in Areas 7 and 7A will not exceed 20,000 consistent with Chapter 6, provision 3(a)(ii).
- (c) U.S. Areas 7 and 7A chum fisheries will not occur prior to October 10.
- (d) Fraser River chum abundance will be updated no later than October 22. If the run size is estimated to be less than 900,000, the U.S. will take immediate action to restrict their fishery impacts on Fraser chum. The Parties will then

meet within 3 days of the update to discuss further U.S. fishing opportunities to meet conservation objectives.

2. Catch Compensation

- (a) The intent of this agreement is to eliminate the total accumulated catch difference by 2008.
- (b) Consistent with Annex IV, Chapter 6, paragraph 5, the difference between actual catches and catch levels specified by this chapter is a total historical accumulated difference of 228,300 chum, (1991 to 2003).
- (c) The historical accumulated difference shall be amortized over the years of this agreement (in 2004 the amount is 46,000).
- (d) Annual differences are defined as actual catches less than the 130,000 base catch ceiling or catches greater than the adjusted total annual catch ceiling. If the base catch ceiling is 20,000 any accumulated difference will be recalculated and re-applied to subsequent years.
- (e) The total annual catch ceiling includes; first, the base catch ceiling, then the amortized historical accumulated difference and the amortized annual difference (to a maximum of 15,000 from any annual shortfall; no limit on overage). The total annual catch ceiling will be calculated each year.
- (f) In any given year, if the U.S. fisheries fail to reach the total annual catch ceiling, the historical accumulated difference and annual difference will not be carried to subsequent years.

3. By-catch

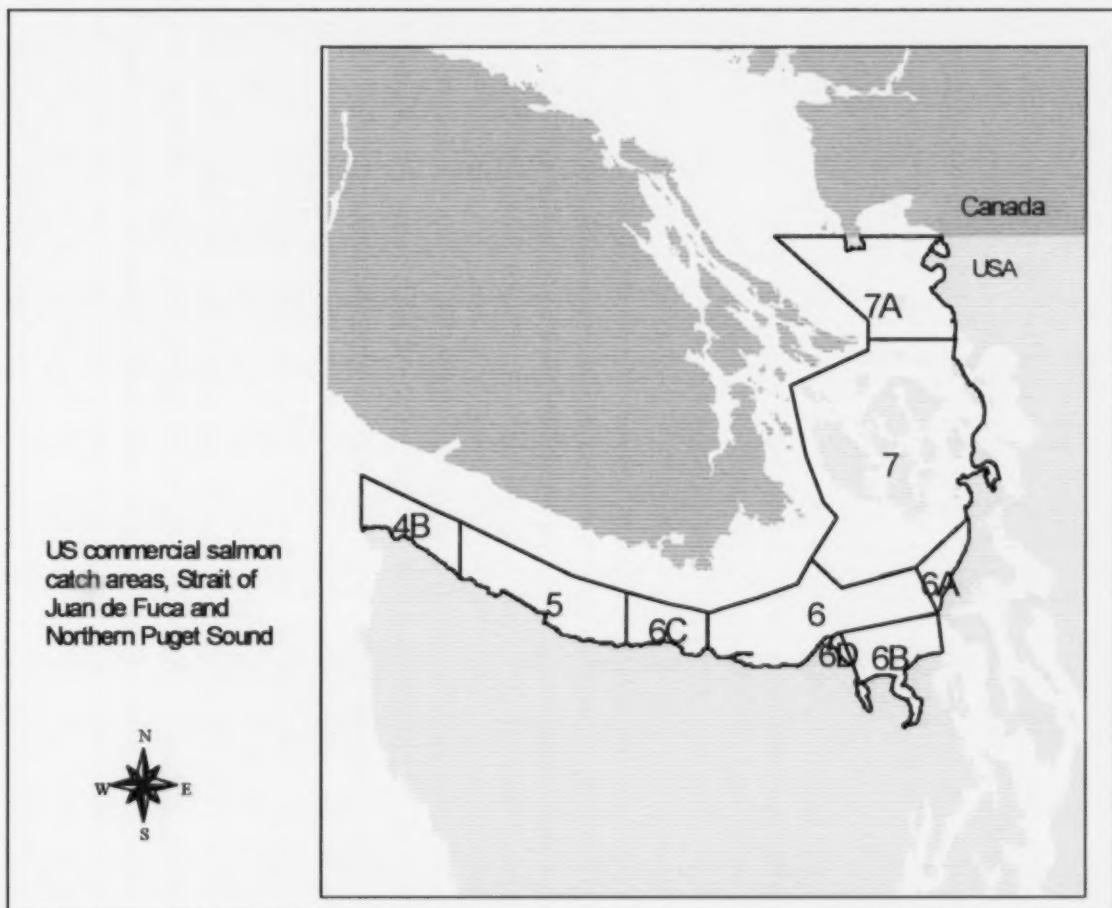
- (a) All by-catch information will be shared between the Parties.

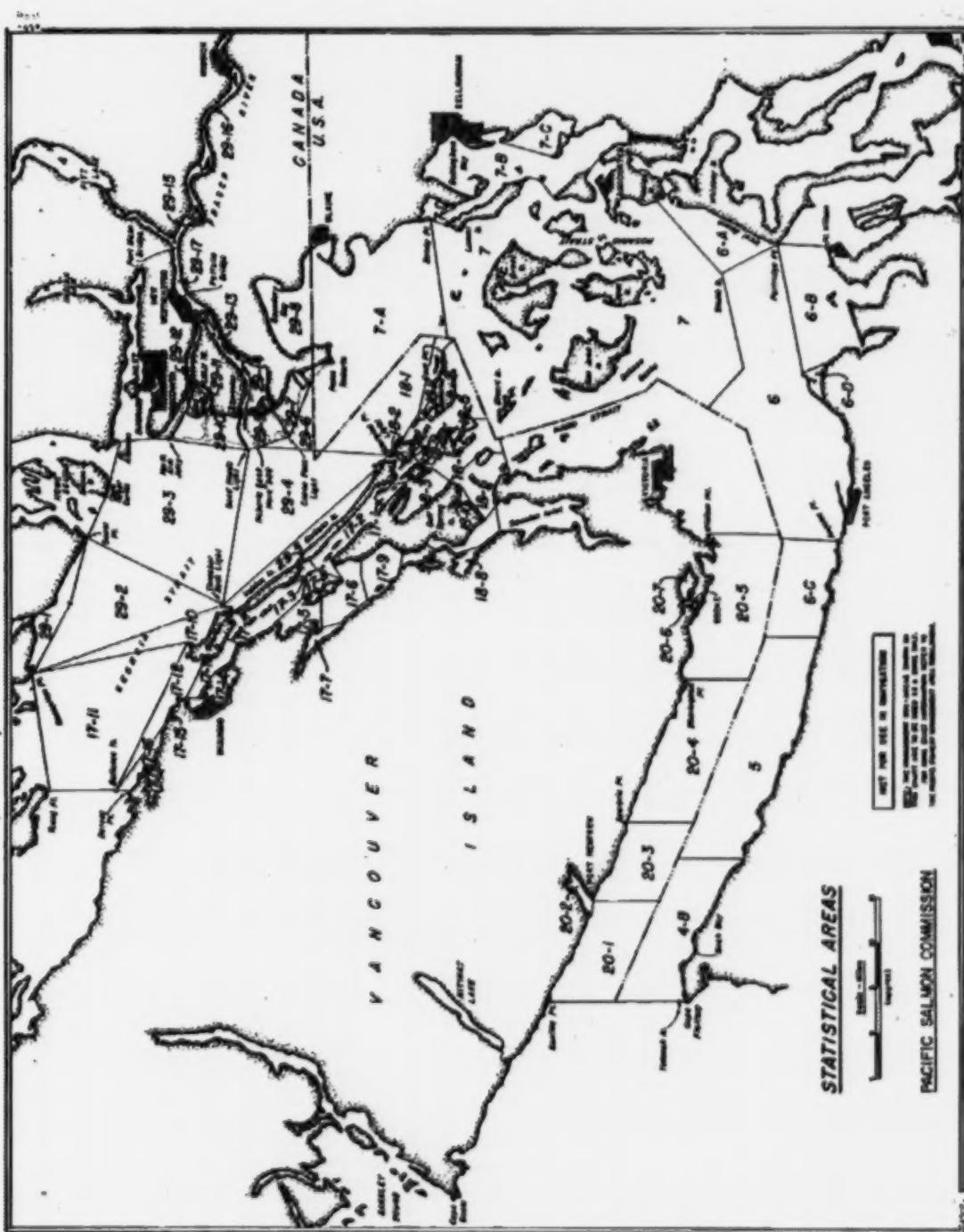
4. Agreement

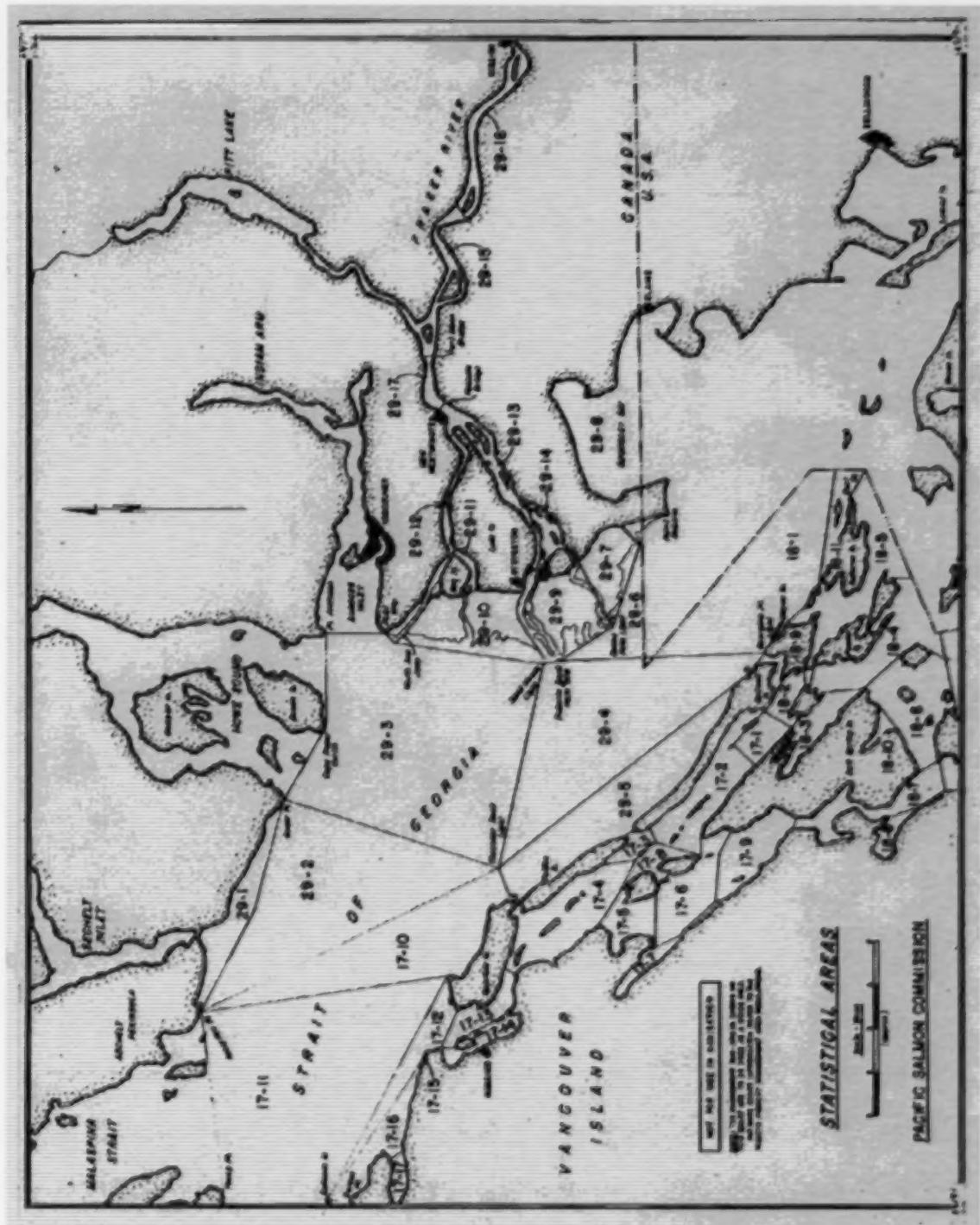
- (b) This agreement will be in effect through 2008 or until the replacement of Annex IV, Chapter 6 related to chum. Modification to this agreement will be subject to approval of both parties.

ATTACHMENT 3:

U.S. AND CANADIAN STATISTICAL AREA MAPS







ATTACHMENT 4: Pacific Rim survey evaluation of genetic variation at 31 single nucleotide polymorphism (SNP) loci (Seeb et al. 2005). Several Washington State collections were included in the study; no B.C. stocks were made available.

